Discovery Research K-12 (DR K-12)

Program Solicitation
09-602

Replaces Document(s):
NSF 08-609

National Science Foundation

Directorate for Education & Human Resources
Research on Learning in Formal and Informal Settings

Preliminary Proposal Due Date(s) ***(optional):***

October 05, 2009

(due by 5 p.m. proposer's local time)

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

January 07, 2010

REVISION NOTES

The Discovery Research K-12 (DR K-12) program solicitation has been revised in order to clarify several aspects of the call for proposals. It includes new material describing project methodologies that may be appropriate at various stages along the research and development trajectory for innovative resources, models, or tools for STEM education. It also explains expectations for external evaluation of project activities, a new opportunity for voluntary submission of preliminary proposals, and an explanation of NSF's policy regarding salary compensation for senior project personnel.

Please be advised that the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) As specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring activities that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Part I: *Grant Proposal Guide* Chapter II for further information about the implementation of this new requirement).

As announced on May 21, 2009, proposers must prepare and submit proposals to the National Science Foundation (NSF) using the NSF FastLane system at http://www.fastlane.nsf.gov/. This approach is being taken to support efficient Grants.gov operations during this busy workload period and in response to OMB direction guidance issued March 9, 2009. NSF will continue to post information about available funding opportunities to Grants.gov FIND and will continue to collaborate with institutions who have invested in system-to-system submission functionality as their preferred proposal submission method. NSF remains committed to the long-standing goal of streamlined grants processing and plans to provide a web services interface for those institutions that want to use their existing grants management systems to directly submit proposals to NSF.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Discovery Research K-12 (DR K-12)

Synopsis of Program:

The Discovery Research K-12 (DR K-12) program seeks to enable significant advances in preK-12 student and teacher learning of the STEM disciplines through development, study, and implementation of resources, models, and technologies for use by students, teachers, and policymakers. Projects funded under this solicitation begin with a research question or a hypothesis about how to improve preK-12 STEM learning and teaching. Projects create or adapt and study innovative resources, models, or technologies and determine how and why implementation affects STEM learning.

DR K-12 invites proposals that meet a variety of educational needs, from those that address immediate and pressing challenges facing preK-12 STEM education to those that anticipate opportunities for the future. DR K-12 especially encourages proposals that challenge existing assumptions about learning and teaching within or across STEM fields, envision needs of learners in 10-15 years, and consider new and innovative ways to educate students and teachers. Project goals, designs, and working strategies should be informed by prior research and practical experience drawn from all relevant disciplines, while focusing on concepts and skills that are central to STEM education.

The DR K-12 program is primarily concerned with improving education of students and teachers in formal settings. As appropriate, the program encourages projects also to draw from knowledge and practice of learning in informal settings. While many projects supported under this solicitation will focus on exploratory development and testing of innovative ideas for some specific facet of STEM education, all proposals must explain how the work can lead ultimately to successful adoption of findings or products in the K-12 enterprise on a national scale.

The DR K-12 program accepts proposals for exploratory projects, full research and development projects, and synthesis projects, as well as for conferences and workshops related to the mission of the program.

Cognizant Program Officer(s):

- Inquiries can be made to either, telephone: (703)292-8620, email: DRLDRK12@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.076 --- Education and Human Resources

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 50 to 70 per year. It is anticipated that about 20-25 Exploratory awards, 20-25 Full Research and Development awards, 5-10 Synthesis awards, and 5-10 Conference/Workshop awards will be made in FY 2010, pending availability of funds.

Anticipated Funding Amount: $55,000,000 in FY 2010 for new awards made under this solicitation, pending availability of funds. Normal limits for funding requests of DR K-12 proposals are as follows: (1) Exploratory projects up to $450,000 with duration up to three years; (2) Full research and development projects up to $3,500,000 with duration up to five years; (3) Projects that study scale-up of STEM education innovations up to $5,000,000 with duration up to five years; (4) Synthesis projects up to $250,000 with duration up to two years; and (5) Conference/Workshop projects up to $100,000 for duration up to two years.

Eligibility Information

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable
- **Preliminary Proposals:** Submission of Preliminary Proposals is optional. Please see the full text of this solicitation for further information.
- **Full Proposal Preparation Instructions:** This solicitation contains information that supplements the standard NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required under this solicitation.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

- **Preliminary Proposal Due Date(s)** ***(optional):***

  October 05, 2009

  (due by 5 p.m. proposer's local time)

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

  January 07, 2010

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria apply.

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

About the National Science Foundation and the Directorate for Education and Human Resources

The National Science Foundation (NSF) is charged with promoting the vitality of the nation's science, technology, engineering and mathematics (STEM) research and education enterprises. As part of this mission, the Directorate for Education and Human Resources (EHR) has primary responsibility for providing national and research-based leadership in STEM education. EHR emphasizes six themes in fulfilling this responsibility:

1. Furthering public understanding of science and advancing STEM literacy;

2. Broadening participation to improve workforce development;

3. Promoting learning through research and evaluation;

4. Promoting cyberlearning strategies to enhance STEM education;

5. Enriching the education of STEM teachers; and

6. Preparing scientists and engineers for tomorrow.

To address these themes, the Directorate sponsors programs in the Divisions of Research on Learning in Formal and Informal Settings (DRL), Undergraduate Education (DUE), Graduate Education (DGE), and Human Resource Development (HRD). The DR K-12 program is managed in DRL.

About the Division of Research on Learning in Formal and Informal Settings

DRL invests in projects to enhance STEM learning for people of all ages. Its mission includes promoting innovative and transformative research, development, and evaluation of learning and teaching in all STEM disciplines. The Division seeks to support both early work on promising innovations and large-scale testing and implementation of proven educational innovations. In doing so, it challenges the field to create the ideas, resources, and human capacity to bring about needed transformation of STEM education for the 21st century. Integration of cutting-edge STEM content and the engagement of STEM researchers are encouraged in all DRL initiatives. In the larger context of Federal support for education research and evaluation, DRL's role is to be a catalyst for change - advancing theory, method, measurement, development, evaluation, and application in STEM education.

The Division's programs offer a set of complementary approaches for advancing research, development, and field-based improvements.

- The Discovery Research K-12 (DR K-12) program enables significant advances in K-12 student and teacher learning of the STEM disciplines through development and study of innovative resources, models, and technologies for use by students, teachers, administrators and policy-makers.
- The Research and Evaluation on Education in Science and Engineering (REESE) program advances research at the frontiers of STEM learning, education, and evaluation, and provides foundational knowledge to improve STEM teaching and learning at all educational levels and in all settings.
- The Informal Science Education (ISE) program invests in projects that promote lifelong learning of STEM by the public, advance the knowledge and practice of informal STEM education, and expand professional capacity to improve informal STEM education.

- The Innovative Technology Experiences for Students and Teachers (ITEST) program invests in projects designed to enhance participation in the U.S. STEM workforce through the design, implementation, scale-up, and testing of technology-intensive educational experiences for students and teachers, and through research studies about issues related to STEM workforce participation.

Each of these programs is intended to improve the national capacity for STEM teaching and learning. They are central to NSF's strategic goals of *Learning* and *Discovery,* helping to cultivate a world-class and broadly inclusive STEM workforce, expanding the scientific literacy of all citizens, and promoting research that advances the frontiers of knowledge.

All research and development activities within DRL aim at generating knowledge and transforming practice in STEM education. DRL's programs are designed to complement each other within a cycle of research and development (see Figure 1) that forms the conceptual framework for its programs (adapted from RAND, 2003, American Statistical Association, 2007, NSF, 2005). All DRL programs are concerned with all five components of the cycle. Work in each part of the cycle forms a vital and compelling foundation for transition to the next part of the cycle.

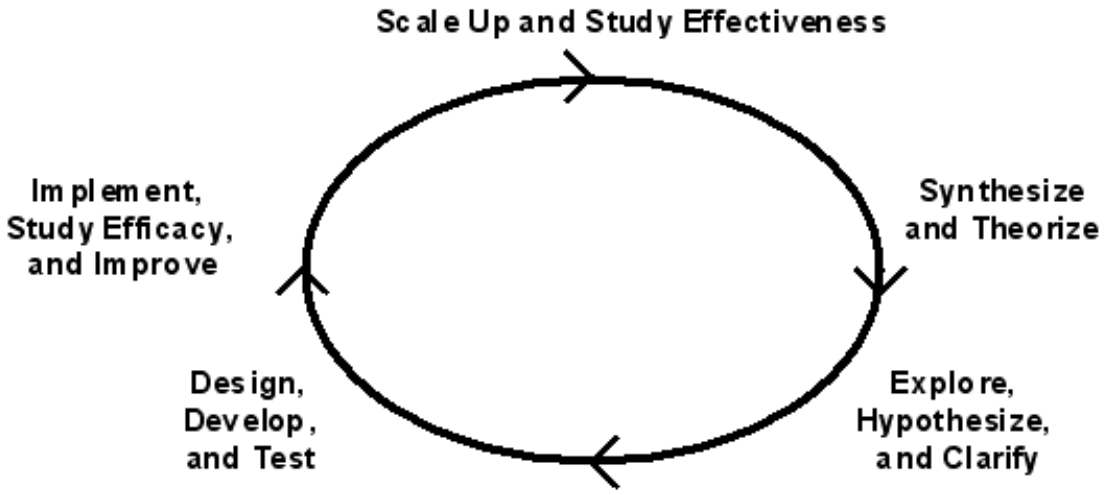

Figure 1: Cycle of Research and Development

The major distinction between the DR K-12 and REESE programs is that DR K-12 projects focus on development and study of specific resources, models and technologies designed to improve STEM education in PreK-12 schools, while REESE projects focus primarily on building theory and knowledge about STEM education across learning contexts and ages. The outcomes of DR K-12 projects will be STEM education innovations that are informed by research and tested in practice. The primary outcomes of REESE projects will be research findings, methods, and theoretical perspectives about STEM education. Proposers who are in doubt about the appropriate program for funding of their work should consult an NSF program officer.

II. PROGRAM DESCRIPTION

The goal of the DR K-12 program is to enable significant advances in preK-12 student and teacher learning of the STEM disciplines through development, implementation, and study of resources, models, and technologies that eventually can and will be used effectively in many sites and circumstances across the nation.

- ***Resources*** include instructional and assessment materials for students and teachers, and they may come in print, multi-media, networked, or virtual forms.
- ***Models*** include curricular frameworks and learning progressions, teacher education and professional development program designs, academic standards, and other guides for learning and teaching.
- ***Technologies*** include tools for cyberlearning such as computer software, labware, networking and collaboration utilities, web-based resources, on--line gaming, virtual learning environments, and portable digital media as well as scientific tools like sensors for data capture or laboratory studies.

The DR K-12 program seeks to maintain a balanced portfolio by supporting projects ranging from those with immediate applicability to those that anticipate and provide the foundation for preK-12 STEM education as it could be in future decades. Projects that address immediate and pressing challenges typically develop and study resources, models, and technologies that could be implemented and brought to scale in the relatively near term, albeit in highly innovative ways.

Projects that anticipate education as it could be in 10-15 years and beyond put forward ideas, concepts, theories, and modes

of research and development that challenge existing assumptions about STEM learning and teaching. Such projects might envision transforming educational systems so that they (1) are dramatically more effective with the diversity of learners they will serve; (2) support STEM learning with collaborative and interactive tools for cyberlearning; (3) help students and teachers draw on the expertise and resources of scientists and practitioners located far from the classroom or teacher education setting; or (4) link in-school and out-of-school STEM learning in imaginative new ways.

DR K-12 accepts proposals for exploratory projects, full research and development projects, synthesis projects, and conferences/workshops. The design of any DR K-12 project begins with a reasonable evidence-based hypothesis about how some aspect of STEM education can be improved. The proposal then offers a plan for developing and/or studying impact of the suggested innovation in STEM learning and teaching. The proposal should articulate clear goals for the project and a plan of work that describes research and development strategies appropriate for attaining its goals. *Projects focused at different stages in the DRL cycle of research and development will naturally choose different development and implementation strategies and different research and project evaluation methods.*

A project whose goal is to ***design, develop, and test*** innovative curriculum materials, technologies, teaching methods, models for teacher preparation or professional development, or assessment tools for an aspect of STEM education might reasonably choose a *design research* strategy to develop and improve its approach through iterative pilot tests (Clements, 2007; Cobb et al., 2003; Lamberg and Middleton, 2009). The project research questions and methods would focus on systematic monitoring of teachers' and students' responses to the innovation in order to inform the development process. Project evaluation activities should document ways that evidence from pilot tests is used to refine the approach.

For instance, developers of a computer-based tutoring system for students might collect data from laboratory trials with individual students in order to guide improvements over time. Developers of innovative curriculum materials for classroom use might involve a small number of teachers in testing the materials and collect data assessing student learning in their classrooms. These data would be analyzed and used to refine the project's theory of action through iterative design/develop/test cycles, and provide empirical evidence about the promise of the innovation for improving STEM education in schools. A similar approach could be applied to design, development, and testing of innovative models or materials for teacher preparation or professional development.

A project whose goal is to ***implement, study efficacy, and improve*** innovative curriculum materials, teaching methods, assessments, technologies, or models for teacher professional development will test its theory of action in a larger number of classrooms, schools, or sites using quasi-experimental or experimental research designs that allow causal inference. Efficacy is defined as how well an intervention works when it is implemented under ideal conditions (Shadish, Cook, and Campbell, 2002, p. 507). The goal of work at this stage in the cycle of research and development is to test the new resource, model, or technology under conditions consistent with its theory of action. Results of these tests may provide strong evidence about what can be expected from the innovation when well-implemented, as well as clarify aspects of implementation that are crucial to obtaining desired outcomes. Efficacy studies require appropriate research designs with power analysis to determine sample sizes required to have sufficient probability for detecting treatment effects. Such studies in STEM education commonly employ multi-level modeling to describe both class- and student-level effects of innovations. However, informative efficacy studies might also have strong qualitative research components to illuminate how, why, and for whom the innovation works.

If an efficacy study of a STEM education innovation shows that its implementation is feasible and produces large and consistent effect sizes, then testing should move to the ***scale-up and study effectiveness*** stage in the cycle of research and development. Effectiveness is defined as how well an intervention works when it is implemented under conditions of actual application (Shadish, Cook, and Campbell, 2002, p. 507). Tests at this stage involve implementation in a greater variety of settings and under conditions that would be typical for many classrooms, schools, systems, or teacher education and professional development programs. Research designs appropriate for scale-up studies could include experimental or quasi-experimental designs that allow causal inference and document the innovation's impact at progressively larger scale and in more varied contexts. The goal of data collection and analysis in effectiveness studies is to determine whether broad implementation of the innovative curriculum, teaching method, assessment, or teacher preparation/professional development strategy is warranted. Such studies should also provide insights into conditions and practices that will make that implementation successful.

Many factors affect whether an educational innovation is actually taken up and broadly used to improve student and/or teacher outcomes. The field of STEM education needs to know more about conditions and contexts that permit an intervention to go to scale and have sustained positive effects. Thus the DR K-12 program is also interested in studies aimed at developing and testing a theory of action for scale-up of innovations.

Researchers and developers interested in creating and studying new resources, models and technologies for STEM education can propose projects focused at any point in the cycle of research and development, provided that the precursor research has been done and that there is evidence to justify entry at a specific point in the cycle. The researchers need not be the developers of the innovation. Projects that explore a new idea should explain how that idea could ultimately lead to findings or products that can be broadly implemented to improve the K-12 STEM education enterprise. However, there is no expectation that a single project of 3-5 years duration should try to include early design/develop/test work as well as efficacy and scale-up studies.

The preceding paragraphs have described appropriate goals and methods for projects at the *design/develop/test, implement/study efficacy/improve,* and *scale-up and study effectiveness* stages of the cycle. However, the DR K-12 program is interested in proposals for work at the *explore, hypothesize, and clarify* and *synthesize and theorize* points on the cycle as well. The ultimate goal is to establish a portfolio of research and development projects that provide better resources, models,

and technologies and more effective teachers into the nation's STEM classrooms.

Abstracts of current DRL projects can be found here.

A. DR K-12 Program Challenges

The DR K-12 program aims to fund a portfolio of projects that build knowledge of effective practice in STEM education assessment, curriculum, instruction, teacher preparation, professional development, and implementation strategy. The program is primarily concerned with improving education of students and teachers in formal settings. Projects are also encouraged to draw from knowledge and practice of learning in informal settings, where appropriate. While many projects supported under this solicitation will focus on exploratory development and testing of innovative ideas for some specific facet of STEM education, all proposals must explain how their work can lead ultimately to successful adoption of findings or products in the K-12 enterprise at a scale beyond that directly supported by the grant. In particular, the program seeks proposals that address one or more of the following key challenges in preK-12 STEM education.

1. How can improved assessment of student knowledge and skills advance preK-12 STEM teaching and learning?

In an era of increased accountability in preK-12 education, resources, models, and technologies for assessing STEM content, skills, and habits of mind must keep pace with and anticipate the demands of instruction and educational policy. Among the most pressing issues is the alignment of preK-12 assessments with the content and learning goals represented in widely used standards documents and held by teachers and policy makers. It is critically important that formative and high stakes summative assessments of STEM learning indicate achievement of the most important disciplinary content - concepts, principles, skills, and reasoning - and the application of that knowledge to problem solving and decision-making.

Assessing the full scope of mathematical, scientific, and technological proficiency in valid and reliable ways presents conceptual, psychometric, and practical challenges. The DR K-12 program seeks proposals for projects that will develop and study assessments consistent with research-based knowledge about student STEM learning and/or study how new forms of assessments can be implemented.

Proposed projects may develop and study (1) models, tools, and technologies for state or national assessment systems that incorporate multiple strategies and organize content around "big ideas"; (2) formative assessment tools for understanding how students learn STEM concepts and processes and strategies for using that understanding to improve instruction and student learning; (3) strategies for using information from school, district, and state databases and high stakes assessments to design appropriate instructional interventions; or (4) assessment practices for measuring desirable STEM education outcomes such as engagement, motivation, aptitude, creativity, and knowledge transfer.

Unresolved questions about teacher quality, preparation, and professional development in STEM disciplines suggest the need for tools that assess teacher knowledge, skills, and classroom performance. Thus proposed DR K-12 projects may also develop and study (1) assessments of teachers' content and pedagogical knowledge; (2) assessments for certification, professional advancement, evaluation, and reward of teachers; and/or (3) assessments of teachers' ability to motivate, engage, and instruct diverse students in STEM settings.

Proposals for development and study of innovative strategies for using cyberlearning tools in assessment are of particular interest to the DR K-12 program. Analyses of existing assessment tools or frameworks, comparison of effects from use of different assessment approaches, and syntheses of relevant research to help assessment developers and policy makers are also eligible for support. In all assessment projects, interdisciplinary collaborations with psychometricians and STEM disciplinary experts are expected.

2. How can all students be assured the opportunity to learn significant STEM content?

The imperative of ensuring a STEM-literate populace and a capable STEM workforce has never been more prominent in national discourse. Current mandates for maintaining U.S. competitiveness in the global economy recognize the importance of a preK-12 STEM education system that improves access to meaningful and successful participation in the STEM disciplines for all students. Given the rapid growth of STEM knowledge and the concomitant flux in knowledge and skills required to work in STEM careers, lifelong opportunities to learn and renew one's knowledge are likely to be features of any STEM-related career. In addition, thoughtful response to societal issues such as climate change, sustainability and energy usage, requires an understanding of interdisciplinary STEM content.

This creates enormous pressures on the preK-12 system to make wise decisions about curricular emphases in the STEM disciplines. The STEM content of the nation's preK-12 schools is influenced by a complex mix of disciplinary traditions, history, practices, standards, and assessments. Some state standards specify content by grade level in mathematics, science, and other STEM disciplines, making innovations in curricular content and approach that can be used nationally especially challenging. In addition, students in the nation's schools have become more diverse in their cultural, linguistic, economic, and educational backgrounds, making the classroom a complex and enriched environment for students and teachers.

The DR K-12 program seeks proposals to develop and study innovative resources, models, and technologies that can increase the nation's capacity to provide more students with access to the most important foundational and emerging concepts and processes of STEM disciplines. Proposals to do this work must explain how their ideas will help students to

develop a coherent and increasingly sophisticated understanding of STEM content and of the ways that new ideas are investigated and knowledge is generated.

DR K-12 especially encourages proposals for projects that use compelling contexts to meet one or more of the following objectives: (1) preparing students to understand increasingly sophisticated content in STEM subjects and to apply the ideas; (2) developing the big ideas needed to understand important interdisciplinary subjects like climate change or alternative energy use, (3) helping students learn STEM practices, modes of inquiry, and engineering design through hands-on and virtual laboratory experiences; (4) providing substantive STEM learning activities that effectively serve the diversity of learners found in contemporary U. S. classrooms.

Formal and informal educational environments provide complementary ways for students to learn STEM content and processes. Local and global communities have the potential to play a vital role in improving students' access to STEM learning and in developing a citizenry and a workforce empowered by technological skills and literacy. Thus the DR K-12 program is interested in projects that develop and study innovative ways of linking different learning environments to enhance STEM education of students and teachers. For example, projects could develop and/or study collaborations of preK-12 schools with out-of-school, science-rich venues, such as university outreach programs, local industries, museums, science centers, communities, and other science-education organizations. Other projects could explore ways to engage experienced scientists, engineers, and mathematicians in mentoring of PreK - 12 students and as resources for teachers.

In response to calls for enhanced STEM education in PreK-12 schools, new signature, charter, magnet, and career academy schools are being created all over the nation, often involving partnerships among education agencies, businesses, and non-profit organizations. Projects that examine the characteristics and promise of such whole-school innovations in STEM teaching and learning are needed. Appropriate studies could examine such innovative school-based models and determine whether the models are producing substantially improved student outcomes. For models that show promise of improving PreK-12 STEM education, subsequent projects could seek understanding of how successes can be replicated and scaled. Such research projects might involve STEM educators and STEM professionals as well as policy and organization systems specialists.

Projects responding to the challenge of assuring that all students have opportunities to learn important STEM content might develop innovative forms of instructional materials like interactive digital textbooks. They might develop and study innovative technology-based resources such as exploratory virtual environments and simulations, visualization tools, virtual scientific instruments, and other ways to support instruction that transcends the limitations imposed by traditional classrooms. DR K-12 is also interested in work exploring the characteristics that make innovative instructional materials and technologies effective - for example, the effects of different formats for representation of STEM content, the effects of using contexts for motivating and facilitating learning of abstract ideas, or the power of new cyberlearning environments like simulations and games. Results of such work have potential to inform design of improved materials and tools.

In development and study of innovative resources, models, and technologies to enhance student learning, projects are urged to build interdisciplinary collaborations with researchers in the STEM disciplines, the learning sciences, and other disciplines. Syntheses of prior work on key questions will also contribute valuable insights to research and development projects and to curricular and instructional decision-making by STEM education practitioners and policymakers. Thus proposals for such synthesis projects are also welcome.

3. How can we enhance the ability of teachers to provide STEM education?

The DR K-12 program recognizes that a well-prepared and well-supported teacher workforce is crucial to excellent preK-12 STEM education. Thus the program seeks proposals to study existing programs and develop innovative models that support learning of preK-12 teachers at all points in their careers. For example, projects in this area might develop and study (1) innovative programs to recruit, certify, induct, and retain STEM teachers; (2) new strategies for helping pre- and in-service teachers develop content and pedagogical knowledge and skills; or (3) innovative strategies for sharing teaching expertise within schools and districts and across the broader national teacher community. As with all DR K-12 projects, these should build on an explicit theory of action with well-specified components and use strong research designs to assess impact.

Teachers today have unprecedented access to and experience with communication, information, and learning technologies (e.g. social networking, virtual gaming, scientific data, and collaborations with scientists around the world). The challenge in teacher preparation and professional development is harnessing this access to information and expertise for application in the professional work of teaching. Thus the DR K-12 program is *especially interested* in supporting projects that anticipate professional learning options and needs of teachers who work in a global environment with powerful cyber infrastructure. Projects addressing this challenge should seek understanding of ways that pre-service and in-service teachers can acquire the skills, knowledge, and confidence they will need to teach in a world with rapidly changing technologies and STEM content.

Resources, models, and technologies to be developed and studied by DR K-12 teacher education projects might include (1) just-in-time online courses or digital library repositories and ways of using web-resources for teaching; (2) models for teacher networking and collaboration and tools to allow productive communication with peers, mentors, parents, and experts around the world; (3) tools that provide multi-dimensional diagnostic information about students; or (4) teacher self-assessment tools. Synthesis projects that bring together findings on current technology--enhanced resources and models to identify new directions for research and development are also encouraged.

4. How are effective innovations successfully implemented, scaled, and sustained in schools and districts in a cost effective manner?

Many studies of innovative resources, models, or technologies have demonstrated positive effects on student or teacher STEM outcomes in a small number of sites under carefully controlled conditions. The next challenge is identifying conditions under which such promising innovations can be successfully implemented and sustained in a broad range of schools and districts across the country.

New studies addressing this challenge may seek to understand how innovative resources, models, or technologies can be implemented and scaled up in increasingly varied sites, the impact of a specific innovation at large scale and over time, and/or the factors that influence implementation and sustainability of innovations. The resources, models or technologies studied in such scale-up research may include work supported by NSF, by other federal agencies, by private industry, or by others.

***Studies of impact at large scale*:** These studies would examine whether effects of specific STEM education interventions found in smaller scale efficacy studies are sustained when an innovation is implemented in a large number of classes, schools, or other situations, and under normal adoption and implementation conditions for the schools or districts. These research projects should be designed to include a variety of sites selected to allow broadly generalizable results.

Because these studies aim to attribute improvements in STEM education practice and/or results to an intervention, the research design must involve an adequate number of individuals, classes, or schools, and give careful attention to measures of fidelity and adaptations when the intervention is implemented. Effectiveness of the innovation should be assessed by appropriate valid and reliable instruments. Disaggregating data may inform stakeholders of the intervention's impact on diverse student groups. Experimental studies with random assignment are encouraged. Longitudinal studies of student achievement may be appropriate for studies of impact at large scale.

***Studies of organization and scale*:** These studies would examine how a specific new resource, model, or technology is implemented, institutionalized, and sustained with the aim of understanding the organizational elements necessary scaling up the innovation. Research questions for such studies might focus on implementation factors like (1) school or district financial investments, leadership, and organizational practices; (2) feasibility and fidelity of classroom implementation; (3) teacher professional development in support of the innovation; (4) engagement of teachers, administrators, and community representatives in adoption and implementation decisions; and/or (5) policy issues such as the innovation's alignment with state standards or assessments. Studies of the implementation and scale-up process might employ qualitative, quantitative, or mixed research methods to document, analyze, and interpret relationships between critical implementation factors and outcomes.

Proposals for either kind of implementation and scale-up study must provide sufficient evidence that research on the resource, model, or technology being studied has provided efficacy data showing positive impact on student or teacher learning under specific conditions. Results of previous rigorous experimental or quasi-experimental studies or meta-analysis of related studies might provide such evidence of efficacy.

B. Additional Program Information Applicable to Proposal Types

The DR K-12 program invites proposals for four types of projects: exploratory projects, full research and development projects, synthesis projects, and conferences/workshops.

Exploratory projects allow researchers and developers an opportunity to undertake preliminary work needed to clarify constructs, assemble theoretical or conceptual foundations, or perform early investigations of an idea for an innovative resource, model, or technology. They might develop that idea into prototype educational materials or practices and conduct research in small scale pilot tests to provide proof of concept and preliminary estimates of impact. These explorations could produce empirical evidence forming the basis of anticipated further research and development work. They must begin with a research question or hypothesis about preK-12 STEM learning and teaching.

Exploratory projects may be of interest to researchers seeking modest funding to launch an innovation or an intriguing novel line of research. They can be used to build a research agenda, establish its potential value, and introduce the views and work of a new research team to the field.

Full research and development projects typically focus their work at one of three points on the cycle of research and development illustrated in Figure 1.

> *Design/Develop/Test* projects start with an idea about how some innovative resource, model, or technology for STEM curriculum, teaching, and/or assessment might improve learning of students or teachers. They develop that idea into prototype educational materials or practices and conduct research in pilot tests to advance the development process and to provide proof of concept and preliminary estimates of impact. These projects are likely to utilize an iterative research and development process. Research and evaluation are likely to be formative in nature, providing information needed for subsequent redesign of the resources, models, or technologies.
>
> *Implement/Study Efficacy/Improve* projects refine promising interventions for which there are pilot data showing proof of concept and study their use in a wider, more realistic, set of implementation conditions. These projects are likely to involve aspects of design research, but focus on determining the efficacy of an intervention when it is strongly supported and when implementation fidelity is likely to be high. They may use experimental or quasi-experimental research designs for testing the intervention's impact. The proposal

should articulate a clear theory of action for the intervention 's contribution to STEM learning, with appropriate research questions at each stage of its development and a plan for evaluation of the project's operations.

Scale-up/Study Effectiveness projects have one or both of the following objectives: (1) Determine the profile of effects from use of an innovative STEM education practice in a wide range of school situations; (2) Determine the conditions required to successfully implement a STEM education intervention in typical schools. Both kinds of studies will typically involve both quantitative and qualitative research methods so that results will allow causal inference as well as insights into contextual factors that help explain the results.

All proposed projects, regardless of location in the cycle of research and development, should have clearly defined deliverable products and plans for dissemination of findings. The deliverables and dissemination strategies will, of course, differ for projects at different points in the cycle.

Synthesis projects are small grants for the survey and analysis of existing knowledge on a topic of critical importance to preK-12 STEM education. Synthesis proposals should identify questions of importance to education research and development, identify areas where the knowledge base is sufficiently robust to support strong scientific claims, and propose rigorous methods for synthesizing findings and drawing conclusions from a range of relevant literatures. Proposals should also identify and defend the criteria to be used for including or excluding studies, audience for the findings, and forums for dissemination of results. Workshops and other meetings may be included as part of the synthesis process.

Conferences and workshops related to the mission of the DR K-12 program are supported. Budgets are expected to be consistent with the duration of the event and the number of participants, but the cost will normally not exceed a total of $100,000 for up to two years. Conferences or workshops should be well-focused and related to the goals of the program. Please see the Grant Proposal Guide Section II. D. for additional information about conference and workshop proposals. Proposals may be submitted at any time, generally at least one year in advance of when the conference would be held. Proposers should contact a program officer before submitting proposals for such events. All conference proposals should provide for an evaluation of the impact of the conference to be conducted at least 12 months after the conference is completed.

References

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III. AWARD INFORMATION

The requested funds and the duration of any DR K-12 project should be commensurate with the task and the importance of the project in answering key questions or providing important resources to the nation. Normal limits for funding requests of DR K-12 proposals are as follows: (1) Exploratory projects up to $450,000 with duration up to three years; (2) Full research and development projects up to $3,500,000 with duration up to five years; (3) Projects that study scale-up of STEM education innovations up to $5,000,000 with duration up to five years; (4) Synthesis projects up to $250,000 with duration up to two years; and (5) Conference/Workshop projects up to $100,000 for duration up to two years. Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. ELIGIBILITY INFORMATION

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Preliminary Proposals*(optional):*

The submission of a preliminary proposal is optional, but strongly recommended for investigators who have not previously submitted to the DR K-12 program. Preliminary proposals are read by experienced reviewers and NSF staff. On the basis of

these readers' judgment of the likelihood that a full proposal based on the preliminary proposal could be successful in the formal peer review process, the submission of a full proposal will be either encouraged or discouraged. This is an advisory opinion only; a proposer may submit a formal proposal in either case. Reviews of preliminary proposals should be available via FastLane no later than 10 weeks after the deadline date. These reviews provide comments to help proposers strengthen their ideas and project plans before submitting a full proposal.

Preliminary proposals must be submitted through FastLane. A preliminary proposal must include the following sections/forms:

- Cover Sheet: See description under Full Proposal Instructions below.
- Project Summary: See description under Full Proposal Instructions below.
- Project Description: See description under Full Proposal Instructions below. In preliminary proposals the length of the Project Description is limited to 6 pages (single-spaced).
- References Cited: See description under Full Proposal Instructions below.
- Biographical Sketches: See description under Full Proposal Instructions below.
- Budget: Preliminary proposals require only a cumulative budget and budget justifications. Budgets for sub-awards are not required.

A preliminary proposal may NOT include the following sections/forms:

- Current and Pending Support
- Facilities, Equipment, and Other Resources
- Special Information and Supplementary Documentation
- Budgets for Sub-awards

Full Proposal Instructions: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the guidelines specified in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-PUBS (7827) or by e-mail from nsfpubs@nsf.gov. ***Information Applicable to all Proposals***

Cover Sheet. Complete this form with the appropriate information. The DR K-12 Program Solicitation number must be entered on the first line of the cover page. All proposals submitted to DR K-12 are assumed to have the potential for conducting research on human subjects. Therefore, proposers must select the human subjects box on the cover sheet and should have prior or pending approval of their research from the appropriate institutional review board (IRB).

Project Summary. The first sentence of the Project Summary should specify the type of proposal (e.g., exploratory, full research and development, synthesis) and the challenge addressed. When appropriate, the second sentence should state the discipline being addressed and identify the audience for the project. Unless the two National Science Board criteria--intellectual merit and broader impacts--are addressed explicitly in separate statements in the project summary, the proposal will be returned without review.

Project Description. Project descriptions are limited to 15 pages and must comply with all formatting requirements of the most current Grant Proposal Guide. Proposals funded under this solicitation must begin with a research question or hypothesis about preK-12 STEM learning.

All proposals for the DR K-12 solicitation must address the following elements in the 15-page project description:

1. Goals and purpose

Proposals of all types (Exploratory, Full Research and Development, Synthesis, and Conferences/Workshops) must articulate the goals of the proposed project and why the goals are important for STEM education. These goals should be linked to one or more of the challenges described above. The proposal should provide a rationale for how the project will improve STEM education for students and/or teachers and advance knowledge and it should explain how products or findings might ultimately be implemented in schools on a large scale.

2. Research and Development Design

The design of any DR K-12 project begins with a hypothesis about how some aspect of STEM education can be improved. The proposal then offers a plan for developing an innovative resource, model, or technology and studying the innovation's impact on STEM learning and teaching. The proposal should articulate a plan of work that describes research and development strategies appropriate for attaining its goals. *Projects focused at different stages in the DRL cycle of research and development will naturally choose different development strategies and different research and evaluation methods.*

a. Development and Study of New Resources, Models, and Technologies

Proposals for projects that develop and/or study new resources, models, and technologies should provide detailed description of planned development and research designs. These designs should provide the basis for explaining how, why, and for whom the intervention or innovation is effective.

a1. Development Designs: Proposals that focus on development of *new* resources, models, or technologies should describe the STEM content, the learning goals, the pedagogical approach, and the needs of students, teachers, other practitioners, or policymakers to be addressed. The nature and scope of the resource, model, or technology should be defined (e.g., a three-week module for third grade science, a one-semester on-line course for mathematics teachers). Proposals should describe the framework that will guide the design and development process. They should explain how particular and relevant design approaches, such as universal design principles or backward design, will be incorporated as appropriate.

Proposals must also outline the planned process to ensure that the resources, models, or technologies are scientifically accurate and pedagogically appropriate. Proposals should describe how pilot and field testing will provide evidence on how students and/or teachers use, interpret, and learn from the resource, model or technology and describe how the evidence will inform subsequent revisions and refinements.

a2. Research Designs: Each proposal should articulate the questions or hypotheses that motivate its development and research activities and show how those questions or hypotheses are informed by current literature and are based on a theoretical or conceptual framework. Research designs should include appropriate data collection and analysis activities to answer the questions or test the hypotheses.

Many DR K-12 projects will have an iterative design that links development and research activities. In such cases the proposal should define the process. For example, a project might begin with the design, development, and testing of a prototype resource, model, or technology and later move to assessment of efficacy. Research in the preliminary phase might include design experiments, teaching experiments, qualitative case studies, and other hypothesis-generating and formative research. The proposal should explain how the results of this preliminary phase will inform later phases of research and development.

Since DR K-12 projects aim to produce resources, models, and technologies that can be broadly implemented to improve aspects of STEM education, it makes sense for such efforts to study, at even early design/develop/test stages, what it will take to implement proposed innovations in different school settings. Thus proposals that include study of the implementation process--in a specific context or in a variety of STEM education contexts--are welcome.

For projects that expect to make causal claims (at any level or of any type), the most appropriate research designs are experimental, quasi-experimental, or other designs that allow causal inference. However, proposals need not (and in many cases should not) limit their research designs to experimental or quasi-experimental methods. Experimental designs may be employed to test one or more elements of a project's knowledge goals (e.g., examine a specific component or subset of the developed materials) or may be used along with other research methods as appropriate. Proposals that involve quasi-experimental or experimental research and quantitative methods should provide appropriate power analyses, anticipated effect sizes, and description of how threats to internal and external validity will be minimized. In cases where experimental or quasi - experimental methods are not feasible or appropriate, the proposer should provide a rationale.

b. Studies of Existing Resources, Models, and/or Technologies

Proposals to conduct studies of *existing* innovative resources, models, or technologies must provide a rationale for why the particular innovation was selected for study. Such studies are not limited to resources, models and technologies developed with NSF funding. Evidence should be presented that previous efficacy studies have shown a positive impact on teacher or student learning, preferably with a discussion of how different sub-groups are affected by the resources, models or technologies. The proposal should explain how the findings of the research will contribute to the improvement of the design and implementation of resources, models, or technologies and result in better preK-12 STEM education for students and/or teachers. Well-designed studies comparing different approaches are welcome.

c. Synthesis Proposals

S*ynthesis* proposals should identify areas of importance to education research, evaluation or practice; identify areas where the knowledge base is sufficiently robust to support strong scientific claims; and propose rigorous methods for meta-analysis and/or synthesis of findings and drawing conclusions from a range of relevant literatures. Proposals should identify the criteria to be used for including or excluding studies.

d. Exploratory Proposals

Exploratory proposals should include a research and/or development design that is appropriate to the questions and knowledge goals to be explored and should justify how the proposed design will yield information useful in assessing the reasonableness of the ideas and the feasibility of future projects.

3. Evaluation

All DR K-12 proposals must have an evaluation component. Project evaluation is normally separate from research activities

that are central to the testing of project hypotheses and claims. Evaluation questions generally focus on the extent to which project activities are of high quality and fulfilling the broad goals and specific objectives expressed in the proposal. The type, extent, and intensity of the evaluation will vary depending on the type of project (exploratory, full research and development, or synthesis), and the level of award.

All proposals should specify the evaluation questions, the designs and methods to be used, the data to be gathered, and the data analysis plans. Responsibilities for evaluation work should be clearly defined. For formative evaluation, plans should address how appropriate and timely feedback will be given to the project leadership team so that it can make modifications to the project activities and address significant issues in the annual report. All projects should describe how the integrity of the evaluation will be ensured.

Full research and development proposals must have both formative and summative evaluation. The summative components of evaluations must be conducted by a researcher or evaluator external to the project and submitted with the NSF final report.

For projects of more limited scope, evaluation will generally be done by an external advisory group composed of content, pedagogical, and methodological experts. The proposal should specify the roles of the committee and the rationale for the expertise of the members. In many cases, the role of these committees may evolve from purely advisory to adjudicatory/ evaluative in vetting the research findings, interpretations, and quality of materials being produced. It is expected that these committees will meet as a group at least yearly.

All resources, models, and technologies developed by DR K-12 projects must undergo independent review by qualified experts in the relevant STEM discipline (e.g., scientists, mathematicians, engineers) and in STEM pedagogy. This may be done by an advisory committee with appropriate expertise. Members may be from the same or different institutions, but must be outside the project.

4. Dissemination

Proposals should include plans for effective dissemination of project findings to researchers, policymakers, and practitioners. The dissemination plan should include a description of anticipated contributions of the research and development activities to teachers, schools, preK-12 administrators, teacher educators, STEM education researchers, and policymakers as appropriate. Projects will be expected to share research and development designs, findings, and overall project information with the DR K-12 Resource Network and report annually to an online data system.

5. Expertise

DR K-12 projects generally involve interdisciplinary teams. In all cases, proposals must describe the expertise needed for the work, how this expertise is incorporated in the project, and who is responsible for each component. Projects should include STEM education researchers, development experts, experienced teachers, STEM researchers, statisticians, psychometricians, informal learning experts, and policy researchers, as appropriate. When feasible, projects should include future researchers and developers (e.g., beginning scholars, postdoctoral associates, graduate students) as part of the project team as a means of building a more diverse community of researchers and developers. Proposals should include a brief narrative describing the expertise of personnel and their contributions to the proposed work. **Each proposal that requests funding to support postdoctoral researchers must include, as a supplementary document, a description of the mentoring activities that will be provided for such individuals. The mentoring plan must not exceed one page.**

6. Results from prior NSF support

The proposal must describe results of prior NSF support for related educational projects in which the PI or co-PI have been involved. In cases where previous projects have resulted in findings, assessments, and/or materials related to the proposed work, include a summary of the past project evaluations that provide compelling evidence of the quality and effectiveness of the resources, models, and technologies developed. How the prior work influences this proposal should be discussed as part of the description of the project.

Biographical Sketches (max. 2 pages)

All activities funded under this solicitation must include biographical sketches for all key personnel. Biographical sketches are limited to two pages each and formatting must comply with the most current Grant Proposal Guide. Biographical sketches should be sufficiently detailed to show that the necessary expertise is available to conduct the project.

Special Information/Supplementary Documentation:

Supplementary documentation is restricted to the statement about mentoring of post-doctoral associates and letters of commitment or collaboration - for example, letters from participating schools or advisory panel members. **Proposals with other material will be returned without review.**

Proposers are reminded to identify the program solicitation number (Populated with NSF Number at Clearance) in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay

processing.

B. Budgetary Information

Cost Sharing: Cost sharing is not required under this solicitation.

Budget Preparation Instructions: A careful and realistic budget in accordance with the general guidelines contained in the NSF Grant Proposal Guide and consistent with the proposed activities of the project should be included. The budget for the total amount of money requested from NSF, with information on salaries and other expenses, including but not limited to, equipment (where allowable), participants, consultants, travel, sub-awards, and indirect costs must be provided. The Budget Justification section should include a budget narrative that describes and validates each of the expenses, including the hourly rate and effort expected from each consultant. DR K-12 proposals generally do not fund equipment that is normally found in schools, universities, and research and development organizations, such as computers. Requests for equipment must be accompanied by justification for its importance to the operation of the project. In addition to the above budgetary items, the budget should include a request for funds to cover the cost of attendance of the Principal Investigator at each year's annual awardee meeting in the Washington, DC area.

Please note that as a general policy, NSF limits salary compensation for senior project personnel to no more than two months of their regular salary in any one year. This limit includes salary compensation received from all NSF-funded grants. If the current and pending support documents for a proposal show individual senior personnel with more than 2 months of annual compensation expected, the rationale for this exception to the rule must be articulated in the budget explanations.

C. Due Dates

- **Preliminary Proposal Due Date(s)** ***(optional):***

  October 05, 2009

  (due by 5 p.m. proposer's local time)

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

  January 07, 2010

Exploratory Projects, Full Research and Development Projects, and Synthesis Projects

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this program solicitation through use of the NSF FastLane system. Detailed instructions regarding the technical aspects of proposal preparation and submission via FastLane are available at: http://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact (s) listed in Section VIII of this funding opportunity.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the Grant Proposal Guide for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: https://www.fastlane.nsf.gov/fastlane.jsp.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program where they will be reviewed if they meet NSF proposal preparation requirements. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to

ensure that reviewers have no conflicts of interest with the proposal.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?
What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf.

Mentoring activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary document, will be evaluated under the Broader Impacts criterion.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (GC-1); * or Research Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after expiration of a grant, the PI also is required to submit a final project report.

Failure to provide the required annual or final project reports will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete.

The DR K-12 program has a program-wide monitoring process. Awardees may be expected to provide data for monitoring purposes.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Inquiries can be made to either, telephone: (703)292-8620, email: DRLDRK12@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

IX. OTHER INFORMATION

The NSF Website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this Website by potential proposers is strongly encouraged. In addition, National Science Foundation Update is a free e-mail subscription service designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the NSF web site.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 40,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at http://www.nsf.gov

- **Location:** 4201 Wilson Blvd. Arlington, VA 22230
- **For General Information** (NSF Information Center)**:** (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

  Send an e-mail to: nsfpubs@nsf.gov

  or telephone: (703) 292-7827
- **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records, " 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Division of Administrative Services
National Science Foundation
Arlington, VA 22230